

Characterizing Water Quality in the North Fork–Fall Creek Hydrologic Unit Area, Tennessee

By Tom Byl and Harold C. Mattraw, Jr.

Project History: The North Fork–Fall Creek (NFFC) Hydrologic Unit Area encompasses a watershed located in Bedford County, Middle Tennessee. Land use in the watershed includes agricultural production (poultry, cattle, and equestrian operations), forestry, residential, and commercial developments. This watershed is situated on a karst (limestone) terrain with sink-holes, caves, and conduit-type subsurface flow. The surface streams and ground-water system are well connected through these conduits. Fecal contamination, such as bacteria and nutrient enrichment, is considered the primary impairment of water quality in the NFFC watershed. The fecal waste input results in excessive algae growth (see photo) and poor water quality. Efforts by the agricultural community to improve water quality have been hindered by the lack of information concerning the source of the fecal contamination. Potential sources include residential septic systems, agricultural animals, and wildlife. In 1994 the U.S. Geological Survey (USGS), in cooperation with several county, State, and Federal agencies, began to characterize the hydrologic conditions in the watershed and to evaluate potential contaminant sources.



Why is this important? The North Fork and Fall Creeks flow into the Duck River which provides drinking water for many communities including Shelbyville and Columbia, Tennessee. Cleaner water usually results in fewer problems at the water-treatment facility. Clean streams are also important for preserving the rich diversity of wildlife found in Tennessee. Identifying the source of contaminants provides the information needed to maximize the effectiveness of best management strategies. Characterizing hydrologic conditions over time provides information on contaminant transport and is the key for mitigating the problem.

Project Goals: The goal of this USGS project is to determine hydrologic conditions throughout the NFFC watershed and to identify actual sources of water-quality impairment. Several activities are currently underway to accomplish this goal. These activities are to:

1. Measure nutrient levels in streams throughout the basins during various seasons.
2. Quantify the amount of fecal bacteria present in the streams.
3. Test for laundry brightener in the streams which indicates septic input.
4. Evaluate biologic communities to determine if the streams are healthy.
5. Develop a genetic technique for fecal bacteria that can identify the source (cattle, poultry, or other).
6. Evaluate the effectiveness of Best Management Practices (BMP) in NFFC watershed.

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1995		2. REPORT TYPE N/A		3. DATES COVERED -	
4. TITLE AND SUBTITLE Characterizing Water Quality in the North Folk-Fall Creek Hydrologic Unit Area, Tennessee				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Department of the Interior 1849 C Street, NW Washington, DC 20240				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release, distribution unlimited					
13. SUPPLEMENTARY NOTES The original document contains color images.					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT SAR	18. NUMBER OF PAGES 2	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

Preliminary Results: During the first year of the study, the USGS has collected data indicating:

1. Nitrate-nitrogen levels ranged from 0.1 to 10 milligrams per liter. (Ten mg/L is the maximum allowed in Tennessee's public drinking water.)
2. Water from the streams exceeded 1,000 fecal bacteria colonies per 100 milliliters (cols./mL) in 14 of 16 tests. (1,000 cols./100 mL is the maximum allowed by Tennessee standards for recreational water use.)
3. Four out of seven streams tested positive for laundry brighteners, suggesting that septic tank outflow may contribute to the problem.
4. Biological surveys show good diversity of organisms in late winter.
5. Preliminary tests at the University of Memphis indicate genetic material (ribonucleic acid) has excellent potential to identify and quantify bacteria in the environment.
6. No extensive conclusions can be made at this time concerning BMP effectiveness since BMP's are still being installed. Time and continued monitoring are necessary to determine the benefits of BMP's.



Summary: The objectives of USGS participation in NFFC are to characterize the hydrologic conditions and determine the sources of nutrients and bacteria contamination in the watershed. Preliminary results are very informative and have provided useful feedback for watershed management. Continued cooperative studies will provide additional information concerning the success of the NFFC program.

Organizations involved in assessment studies of the NFFC HUA:

Bedford County Conservation District
Duck River Agency
Tennessee Department of Agriculture
Tennessee Department of Environment and Conservation
University of Memphis, Department of Biology
University of Tennessee, Agricultural Extension Service
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. Department of Interior, U.S. Geological Survey

For more information contact:

District Chief
U.S. Geological Survey
810 Broadway, Suite 500
Nashville, TN 37203
(615) 736-5424



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